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"Molded block"

The invention relates to a molded block according to the preamble of Claim 1.

Prior art:

US Patent No. 4,792,257 has disclosed a set of paving stones which comprises a paving stone which is square in plan view and whose lateral, planar faces have rounded portions running toward the vertical side edges which, in plan view, are designed as a curve with radii of curvature decreasing constantly toward the vertical side edges. Rounded portions of this type are referred to as "clothoids".

Such a "standard block" with a square base in plan view is supplemented in this prior art by a "1/2 block" with half the base and a "1 1/2 block" with 1.5 times the base. Both supplementary blocks again have, in their corner regions, clothoidal rounded portions in plan view. Such clothoids may be present on one or more side faces.

The side faces and the upper and lower faces are otherwise formed as planar faces. The circumferential edge regions can in this case be designed to be irregularly broken. In this known set of blocks, the height of the paving stones is always considerably lower than the edge length of the upper, square face of the standard block. This ratio is about 2.5.

DE 33 25 752 has disclosed a concrete paving stone which has approximately the geometric shape of the 1 1/2 block of US Patent 4,792,257, that is to say it is an elongate parallelepiped. In this case, however, the longer side edge in the paving stone according to DE 33 25 752 is about three times as long as the shorter side face. The height of this paving stone

includes a further dimension which is lower than the width of the shorter side face. The special feature in this prior art resides in the fact that the block form can be laid differently. In this case, because of the different dimensions between block height and block width, mixed laying is not possible, since a paving stone rotated through 90° about the longitudinal axis forms a higher laying height because of its width. Such a paving stone rotated through 90° gives a non-planar surface structure in its laying pattern, because of the clothoid being laid at the top, since the clothoid shape comes to lie in the upper face. As can be seen from the figures of DE 33 25 752, different surface structures can therefore be laid with a molded block. However, mixed laying is not possible.

Object and advantages of the invention:

The invention is based on the object of proposing a molded block which, on account of its shape, provides the possibility of flexible laying. At the same time, both planar and non-planar faces are to be produced, which can also be configured in mixed form.

This object is achieved by a molded block according to Claim 1.

Advantageous and expedient developments of the molded block specified in the main claim are presented in the subclaims.

The invention is based on the finding that a planar or a profiled surface structure of a paving-stone covering can be implemented with, for example, only one molded block if the molded block has different geometric structures on its outer faces, which can be used as desired in order to configure the paving-stone surface. If, in particular, the paving stone is used in the form of a cube, that is to say with side edges of equal

length, then different configuration of the sides of the cube can lead to the configuration of different surface structures. In this case, the present invention additionally makes use of the feature of the geometric modification of a cube face. This is done in such a way that either a planar cube face is structured in its side contour, or that a cube face intrinsically has a two-dimensional or three-dimensional shape. As a result of these measures, by rotating the cube about a horizontal or a vertical axis of rotation, in each case a different "cube surface" can be used as the upper surface to be walked on, the respectively different structures of these faces leading to a very different appearance of the paving-stone covering. In particular, planar faces and curved faces can be selected as the upper face of a respective molded block, and can in each case be combined with one another.

In a development of this basic idea, a so-called "double cube" or "twofold cube" can also be used, which corresponds to the dimensions of two basic elements laid beside each other. This twofold cube can also be laid differently by its being rotated through 90°, for example, about its horizontal longitudinal axis. For this purpose, however, the block height and the shorter broad side of the block must agree in their length dimension, in order to be inserted into the grid pattern without any projection, that is to say at the same laying height.

Also advantageous is the use of a fourfold cube, that is to say the basic block is joined together four times about a vertical longitudinal axis, it being possible for such a block to be rotated only about its vertical mid-axis in the composite surface.

In a particular refinement of the invention, the faces of such block shapes are provided with a "clothoid", that is to say the intrinsically planar side face has a

rounded portion toward the edge region whose radius of curvature decreases constantly toward the side edge. These clothoids can be present singly or in duplicate on each side face, the result being a very different laying pattern. If, according to the invention, wedge blocks are also added to such a building-set arrangement, the result is overall a paving-stone building set which permits flexible laying. In this case, the laying can be designed to be straight or curved, it being possible, in the case of a curve, for the corners aligned toward the center of the curve to be sharpened by one or two clothoids being arranged at such points.

If, in this connection, laying examples are provided, then the result may be surfaces structured very differently in a straight or a curved shape, in particular with the cube structure.

Further details of the invention are illustrated in the drawings and will be explained in more detail using the following description.

In the drawings:

Fig. 1a shows a molded block as a "standard block" in cube form with a planar upper face,

Fig. 1b shows the block form of Fig. 1a rotated through 90° with an uneven upper face,

Fig. 1c shows a plan view or a side view of the block form of Figs. 1a, 1b,

Fig. 2a shows a "twofold block" with a planar upper face,

Fig. 2b shows the block form of Fig. 2a rotated through 90° about its longitudinal axis, with a structured upper face,

Fig. 2c shows a plan view or a side view of the block form of Figs 2a, 2b,

Fig. 3 shows a plan view of a "fourfold block",

Fig. 4 shows a laying example of the block forms of Figs 1a, 1b,

Fig. 5 shows a laying example of the block forms of Figs 1 to 3,

Figs 6a to 6e show variants of the block form of Figures 1 and 2,

Fig. 6j shows a variant of the block form of Figs 1, 2 with reduced dimensions,

Figs 6h, 6i show a block variant with a wedge form, and

Fig. 7 shows a laying example with the block forms of Fig. 6.

Description of the exemplary embodiments

Fig. 1 shows the standard block, as it is known, or basic block 1, which has the basic structure of a cube with the respective equal edge length L. The cube has an upper planar horizontal face 2, a lower planar and horizontal supporting face 3 and four vertical side faces 4 to 7. The upper corner points of the cube are designated by reference symbols 8 to 11, the lower corner points of the cube are designated by reference symbols 12 to 15. Similarly, the vertical connecting

lines through the corner points 8 to 15 are designated by the reference symbols 16 to 19.

The plan view of the cube-shaped block form of Fig. 1a is illustrated in Fig. 1c.

Fig. 1a and Fig. 1c reveal a first rounded portion 20 of the side face 5, that is to say the side face 5 has a rounded portion 20 which is directed toward the vertical connecting line 16 and whose radius of curvature R changes continuously toward the corner region. Such a rounded portion is designated a clothoid, which in the further text is designated by the general reference symbol K. The shape of such a clothoid is described most extensively in terms of its extent and dimensions and its arrangement in the earlier US Patent No. 4,792,257. Reference is hereby expressly made to this document. In this regard, this document is incorporated in the present application. In particular, the clothoids may have different dimensions, that is to say the beginning of the clothoid can extend over different length sections on the side wall.

Figures 1a, 1c further reveal that the side face 7 opposite the side face 5 has two rounded portions 21, 22, which are likewise formed as clothoids K. In this case, the clothoid 21 extends from the planar side face 7 in the direction of the corner point 11 and vertical side edge 19 and, as it increasingly approaches this side edge, has a radius of curvature R which becomes smaller and smaller. The same applies, in mirror-image fashion in relation to the vertical mid-plane 23, with regard to the rounded portion or clothoid 22.

The clothoid 22 can also extend on the side face 6 toward the corner point 10. This is shown dashed by 22'. In the region of the vertical connecting line 17

there is no rounded portion, so that this connecting line 17 simultaneously forms the block side edge 17.

Similarly, there could be a clothoid on the side face 4 as well, the rounded portion extending either toward the corner point 8 or toward the corner point 11.

As a result of the clothoids 20 to 22, the cube form of the basic block 1 is therefore somewhat modified in terms of its structure, that is to say corner regions are cut off over a large area by the rounded portion.

The cube structure of the paving stone of Fig. 1a has vertical planes of symmetry 23, 24. Fig. 1a reveals horizontal axes of rotation 25, 26 and a vertical axis of rotation 27 through the center of symmetry 28.

The cube-shaped block form of Fig. 1a makes it possible to rotate this block in all directions about the axes of rotation 25, 26, 27, in each case through 90° or 180°.

If, for example, the block of Fig. 1a is rotated in the clockwise direction about the horizontal axis of rotation 25 (arrow 29), then the result is the block form of Fig. 1b. The rear side face 7 becomes the upper face 7', the upper face 2 becomes the side face 2' and the front side face 3 becomes the lower side face 3'. If the paving stone of Fig. 1 has an upper planar face 2, then in the event of a rotation through 90° about the axis of rotation 25, this face becomes the upper face in relation to a profiled surface 7' having the two clothoids 21, 22. By this means, the upper structure is beveled off in two directions by the clothoids 21, 22 in the direction of the side edges. This imparts a spatial two-dimensional structure to the upper face 7'.

The exemplary embodiments 2a to 2c deal with a twofold block or double block 30. If the block form of Fig. 1a is doubled by the length 2L, then the result is the block form of Fig. 2a with a longer side edge 2L, with a shorter side edge L and a height L. The paving stone of Fig. 2a has an upper planar face 31, a lower supporting face 32 and vertical side faces 33 to 36. The front face 34 again has a rounded portion 20 in the form of a clothoid K, the rear face 36 has two rounded portions 21, 22 in the form of a clothoid K. These clothoids correspond to the description of Figs 1a, 1c. According to the exemplary illustration of Fig. 2c, the clothoids can also be located on the side face 35 as clothoids 22'.

Since the side faces 33, 35 substantially have a square cross section, the block form of Fig. 2a can be rotated about a horizontal longitudinal mid-axis 25' (arrow 29). As a result, the rear side 36 comes into the upper position according to Fig. 2b, so that the rounded portions 21, 22 formed as clothoids again appear as the upper face according to the illustration in Fig. 2b. If an equally high surface of the blocks is desired in spite of the rotation of such blocks, the twofold block of Fig. 2a can merely be rotated in 90° steps about the horizontal axis of rotation 25'.

Fig. 2b shows, in a form offset to the right, the variant having a clothoid 22' on the side face 35.

If the block form of Fig. 2 comprises two cube structures according to Fig. 1 located beside each other, then in the exemplary embodiment of Fig. 3, the effect is of four basic stones laid beside one another in their cube form. This fourfold block 37 accordingly has, in its square plan view of Fig. 3, an edge length of 2L in each case. The upper planar face is designated by 38, a lower, invisible supporting face is designated by reference symbol 39. The vertical side faces are

designated by 40 to 43. As already described in Figures 1 and 2, the front lateral face 41 has a lateral clothoidal rounded portion 20. Similarly, the opposite vertical side face 43 has rounded portions 21, 22 which point toward both corner regions and are likewise of clothoidal design.

Likewise, as illustrated by way of example, the side face 42 can alternatively have a clothoid 22'. The height of the fourfold block 37 illustrated in plan view is again the basic dimension L.

In order to form an equal height layer of a laid surface, the fourfold block of Fig. 3 can be rotated through 90° or 180° only about the vertical axis of rotation 27. Of course, it is also possible for the twofold block 30 to carry out this rotational movement.

The implementation of the clothoid form 20 to 22 can be carried out on any desired side face or surface. A modified rounded portion or bevel is also conceivable.

The block forms of Figs 2 and 3 can also be placed on edge to form an edge stone, so that these project above the remaining paving-stone covering by a length L. This makes a simple edge border possible with the same block form. Here, too, the block forms can be rotated in such a way that the upper face is designed to be more rounded or more flat.

The illustration of Fig. 4 shows a first laying example of the block forms of Fig. 1a and Fig. 1b.

If the standard block 1 in an arrangement according to Fig. 1a is laid with a planar upper face 2, then this is illustrated in the top row 44 of Fig. 4. Each normal block 1 within the row 44 can still be rotated in the clockwise direction or the counterclockwise direction about its vertical axis of rotation 27, corresponding

to the arrow representation 45. By this means, the arrangement of the clothoids 20 to 22 can be shifted into each corner region. The arrangement of the clothoids 20 to 22 or else other clothoids can be varied in terms of their position on the basis of such rotational movements.

In the next row 46, the block form 1' corresponding to the illustration of Fig. 1b is shown. In this case, the upper face 7' is visible, so that the rounded portions or clothoids 21, 22 form a rounded upper face. Accordingly, a structured three-dimensional upper face 7' is arranged in row 46, beside the planar surface in row 44.

The next row 47 can again be formed like the row 44. The lowest row 48 shows a rotation of the standard blocks 1' in row 46 about a vertical axis of rotation 27'.

Of course, the standard blocks 1, 1' with a planar surface or rounded surface 7' can also be varied as desired within a row.

In the exemplary embodiment of Fig. 5, the block forms of Figs 1 to 3 are combined. The upper row 49 shows the twofold block 30 of Fig. 2a, the row 50 lying alongside shows the block form 30' of Fig. 2b, that is to say a block form of row 49 rotated through 90° about the horizontal longitudinal axis.

Row 51 shows the block form analogous to the row 44 in Fig. 4, row 52 shows an arrangement analogous to the row 48 in Fig. 4, but with two basic blocks 1' located beside each other in each case.

Finally, the lower row 53 illustrated in Fig. 5 shows the block form 37 of Fig. 3.

It goes without saying that the block forms corresponding to the illustration of Fig. 4 can be varied as desired. In this case, both a running unit with offset joints and a crossing unit with mutually crossing joints can be established. In addition, the twofold blocks 30 and the fourfold blocks 37 can also be placed on edge in order to form edge boundaries.

Variants of the standard block 1, 1' of the Figures 1a to 1c are illustrated in Figures 6a to 6e with the capital letters A to E. In this case, these may be a plan view of a corresponding cube-shaped standard block 1 whose clothoids A are arranged on different side faces. If the upper face is again designated by 2, the vertical side faces by reference symbols 4 to 7, the result is the variations illustrated. In Fig. 6a, the side faces 4, 6, 7 have a clothoid K running around in the clockwise direction in each case in the corner regions.

A right angle of a corner region without a clothoid is marked appropriately. Fig. 6b shows a clothoid K on the side faces 4, 5 and 6, which are arranged to run in opposite directions on the side faces 5 and 6, that is to say in the counterclockwise direction, and in the clockwise direction on the side face 4. The exemplary embodiment of Fig. 6c shows a clothoid K in the region of the side face 5 with otherwise three rectangular corner regions. Fig. 6d shows a clothoid K on the side face 5 and on the side face 7, arranged so as to run in the counterclockwise direction. Finally, Fig. 6e shows a clothoid K on the side face 4 and on the side face 6, running in the clockwise direction.

The edge length L of the cube 1 can, for example, have a dimension of 9.5 x 9.5 x 9.5 cm. In order, in particular, to lay areas in accordance with the illustration of Fig. 7, additional block forms according to Figs 6j to 6i are provided, and are

designated by the letters J, H and I. The block form of Fig. 6j can have any outline structure of the block forms of Figs 6a to 6e. In Fig. 6j, it is illustrated in a similar way to Fig. 6c, with a clothoid K on the side face 5.

If the side edge L is for example L ≈ 95 mm in the block forms previously specified, then the block form of Fig. 6j can have an edge length of the cube of L' ≈ 80 mm. This special block form of Fig. 6j is designated a "small block" 54. The block form of Fig. 6h again relates to a special block as a first wedge block 55, which has an excess length L_1 ≈ 100 mm and a shortened width L_2 ≈ 75 mm, with a height L defined for all the blocks in the building set. The plan view of Fig. 6h accordingly shows a block 55 which is slightly rectangular in outline.

If, in Fig. 6h, the vertical side edges are again designated by the reference symbols 4 to 7, then the two side faces 4 and 6 are designed to be wedge-shaped and, nevertheless, have clothoidal rounded portions K running in the clockwise direction in their corner regions. The planar side face 4 forms a first wedge angle $\alpha 1 \approx 2.5°$, the planar side face 6 forms a second wedge angle $\alpha 2 \approx 3.0°$. The opening of the wedge angle is oriented in the same direction, that is to say downward in Fig. 6h.

The upper side face 7 also has a clothoid K running in the clockwise direction.

The second wedge block 56 is a further supplementary block with the same special length L_1 as the wedge block of Fig. 6h, it being possible for L_1 to be approximately equal to 100 mm. The further special length L_3 is designed, for example, at 87 mm in the system. Here, too, the side faces 4 and 6 have a first wedge angle $\beta 1 \approx 1.5°$ and a second wedge angle $\beta 2 \approx$

1.5°. The clothoids K running in the clockwise direction are again arranged in the corner region of the side faces 4, 6, the clothoid on the side face 4 being arranged opposite the wedge angle $\beta 1$.

The block forms illustrated in plan view in Figures 6a to 6i are reproduced in a laying example according to Fig. 7 in a curved laying pattern. In this case, all the block forms are designated by the corresponding capital letters. It can be seen from this that the block forms can be rotated in a [lacuna] in each case about a vertical mid-axis of rotation, in order to come into an appropriately desired position. This desired position can result from the fact that the corner regions adjoining one another on the inside of a curve adjoin one another rather without a clothoid than with a corresponding clothoid. The blocks can therefore be rotated appropriately about their vertical axis of rotation in order to come into a desired position. For example, two to three clothoids are laid together at the lower butt point, in order to form a curved laying pattern. In this case, the longer wedge blocks H and I can be laid both toward the center of the circle and in the transverse direction with respect to this. By this means, using cube-shaped and slightly rectangular and wedge-shaped blocks, a particularly well-structured curve shape can be laid. If the curved pattern illustrated in Fig. 7 is desired, it is possible, for example, for a template, for example of degradable filter paper, to be laid underneath, on which the blocks are laid in the form illustrated. Of course, the individual blocks must be marked appropriately in some form.

Illustrated in the lower region of Fig. 7 are two curved rows, with appropriate dimensioning specified by way of example.

The invention is not restricted to the exemplary embodiments illustrated and described. Instead, it also comprises all developments by those skilled in the art within the context of the protective claims. In particular, the clothoids can also have a modified shape, clothoids being quite particularly outstanding in terms of their configuration.

In addition, the block forms illustrated in Fig. 7 can be configured to be planar, in accordance with the plan view of Figures 6a to 6i. By means of appropriate rotation of the blocks about a horizontal axis of rotation, a physically rounded surface with clothoids on the upper side can also be produced. This provides an appearance with a planar and structured upper face. Furthermore, all the circumferential block edges can be wholly or partly broken or rounded, in a way similar for example to the illustration in Figs 1b to 3b of US Patent 47,92,257.

List of reference symbols:

1. Basic block
2. Upper face
3. Lower face
4. Side face
5. Side face
6. Side face
7. Side face
8. Upper corner point
9. Upper corner point
10. Upper corner point
11. Upper corner point
12. Lower corner point
13. Lower corner point
14. Lower corner point
15. Lower corner point
16. Vertical connecting line
17. Vertical connecting line
18. Vertical connecting line
19. Vertical connecting line
20. Rounded portion
21. Rounded portion
22. Rounded portion
23. Vertical mid-plane
24. Vertical mid-plane
25. Horizontal axis of rotation
26. Horizontal axis of rotation
27. Vertical axis of rotation
28. Center of symmetry
29. Arrow
30. Twofold block/double block
31. Upper face
32. Lower supporting face
33. Vertical side face
34. Vertical side face
35. Vertical side face
36. Vertical side face
37. Fourfold block
38. Upper planar face
39. Supporting face
40. Side face
41. Side face
42. Side face
43. Side face
44. Upper row
45. Arrow
46. Row
47. Row
48. Row
49. Row
50. Row
51. Row
52. Row
53. Row
54. Small block
55. 1st wedge block
56. 2nd wedge block
57. Curved row
58. Curved row